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Histopathological analysis in functional endoscopic sinus surgery

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ABSTRACT

Aims: The aim of this study is to determine the histopathological diagnosis distribution and benign-malignant ratios of patients who have undergone functional endoscopic sinus surgery (FESS).

Methods: The pathology results of patients who underwent FESS in our clinic between 2018 and 2022 were retrospectively scanned from the hospital database. Demographic characteristics (age, gender) and histopathological findings in the files of the patients were recorded. Histopathological diagnosis distributions and benign-malignant ratios were determined.

Results: A total of 365 patients (262 men (71.8%) and 103 women (28.2%)) were retrospectively scanned from the hospital database. The mean age of the patients was 40.09±13.79 (Mean±SD). The most common histopathological diagnoses were nasal polyp (76.4%), chronic inflammation, edema and congestion (Chronic sinusitis) (16.7%), respectively. Among the malignant tumors, squamous cell carcinoma (0.8%) was observed. Inverted papillomas, which are likely to transform into malignancy, were observed at a rate of 1.0%. Considering the histopathological diagnosis distribution by gender, there was no statistically significant difference ($p>0.05$). Considering the histopathological diagnosis distribution by age, there was a statistically significant difference ($p=0.01$). Malignant pathologies were seen in advanced ages.

Conclusion: The most common histopathological result in patients undergoing FESS is non-neoplastic lesions. However, malignancy diagnoses are encountered, albeit in a small number. Therefore, routine histopathology of FESS is essential to identify pathologies with different prognosis.

Keywords: Paranasal sinuses, endoscopy, pathology, nasal polyps, paranasal sinus neoplasm

INTRODUCTION

Sinonasal diseases are one of the diseases that most frequently require referral to a physician in childhood and adulthood. These diseases mostly respond to medical treatments, but chronic inflammatory, polypoid diseases and mass lesions require surgery.[1]

Functional endoscopic sinus surgery (FESS) has become a safe and effective procedure in the surgical treatment of chronic rhinosinusitis and sinonasal masses, depending on the increase in knowledge of endonasal anatomy and developments in endoscopic and radiological imaging methods. The advantages of FESS over conventional surgical methods are that it is less invasive, causes less damage to the surrounding tissues, leaves no visible scars, and provides a better view of the operation area. Nasal polyps, chronic rhinosinusitis, antrochoanal polyps, mucocele, sinonasal benign and malignant masses are the diseases in which endoscopic sinus surgery is most frequently applied.[2] It has become the most common procedure especially in chronic rhinosinusitis and nasal polyps resistant to medical treatment.[3-5]

Sinonasal neoplasms are a diverse group of tumors originating from the paranasal sinuses and nasal cavity. When sinonasal tumors accompany chronic rhinosinusitis, they may be masked and diagnosis may be delayed. For this reason, all materials removed during surgery are sent for histopathological examination and possible additional diseases are investigated. Paranasal sinus carcinomas are rare and constitute only 3% of all malignancies in the head and neck region.[6] Squamous cell carcinoma (SCC) is the most common tumor, presenting as inverted papillomas or de novo in approximately 10% of cases.[7-9] The paranasal sinuses are air-filled spaces that allow the tumor to grow to substantial size before symptoms and signs develop. Therefore, most patients present at an advanced stage and there is widespread involvement of neighboring regions at the time of diagnosis.[10,11]

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The aim of this study is to evaluate the histopathological results of tissue samples taken during FESS and to determine the histopathological diagnosis distribution and benign-malignant ratios.

METHODS

Ethical Approval

The study was approved by the Kırıkkale University Faculty of Medicine Ethics Committee with the decision numbered 2023.04.09 and dated 19.04.2023. Written informed consent was not obtained because this study was conducted as a retrospective file review. All procedures were carried out in accordance with ethical rules and the principles of the Declaration of Helsinki.

Participants and Study Design

In the study, the files of patients who underwent FESS in the Otorhinolaryngology department of a secondary health care institution between 2018 and 2022 were retrospectively scanned from the hospital automation system. Demographic characteristics (age, gender) and histopathological findings in the files of the patients were recorded. The histopathological diagnosis distribution and benign-malignant ratios of the patients who underwent FESS were determined. Patients whose materials were sent to the pathology department but whose histopathological diagnosis could not be reached in the file archive scan were excluded from the study. All patients who underwent routine and diagnostic FESS were included in the study. Patients who underwent diagnostic FESS were decided by examining the patient files. Patients with certain risk factors in the patient file were recorded as diagnostic FESS. These risk factors are prominent nosebleeds, unilateral pathology, appearance different from chronic rhinosinusitis (CRS) with or without nasal polyps (NP) on nasal endoscopy, palpable cervical lymph nodes, unexplained weight loss, or unexplained structural symptoms (fever, fatigue). Routine FESS procedure was performed in cases of CRS with/without NP and in cases without preoperative clinical suspicion. Unilateral and bilateral FESS cases were recorded. In diagnostic FESS surgery, the material was partially excised. Further treatment options are planned according to the histopathological diagnosis.

FESS Surgery

FESS was performed under general anesthesia with the Messerklinger technique.[2] An infundibulectomy was performed by cutting the anterior attachment of the uncinate process; then the ethmoid bulla was opened and removed. The decision to open the maxillary antrum and explore the posterior ethmoids, frontal recess, and sphenoids was dependent on the extent of the disease, as evidenced by CT scan and surgical findings.

Histopathological Examination

Standard histopathological examination; macroscopic examination, fixation in formalin, decalcification if necessary, sampling of the sample, follow-up stage (with automatic tracking device), blocking of paraffin embedded tissue, section preparation (4-5 microns thick), staining with Hematoxylin-Eosin (HE) and examining the prepared sections under a light microscope.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Normal distribution parameters and Shapiro-Wilk test were used to evaluate the normality of the data distribution. Nominal categorical variables were compared with the chi-square test and Fisher's precision test. Mann-Whitney U and Kruskal-Wallis tests were used for non-parametric variables. Statistical significance level was accepted as $p < 0.05$.

RESULTS

A total of 365 patients 262 men (71.8%) and 103 women (28.2%) who underwent functional endoscopic sinus surgery were retrospectively scanned from the hospital database. The mean age of the patients was 40.09±13.79 (Mean±SD). FESS was applied unilaterally to 34 patients and bilaterally to 331 patients. There were 26 patients who underwent diagnostic FESC in the presence of risk factors. Of 26 patients, 4 were premalignant and 3 were histopathologically malignant. 339 patients had CRS with/without NP or routine FESS without preoperative clinical suspicion. No malignancy was detected in any patient who underwent routine FESS.

When we look at the histopathological diagnoses, the most common nasal polyp was seen with a rate of 76.4%. The second most common diagnosis was chronic inflammation, edema and congestion (chronic sinusitis). It was observed in inverted papilloma and squamous cell carcinoma in the nasal cavity and paranasal sinuses (1.0%, 0.8%, respectively). Histopathological images of the nasal polyp are shown in **Figure 1**, inverted papilloma in **Figure 2**, and squamous cell carcinoma in **Figure 3**.

Considering the histopathological diagnosis distribution by gender, there was no statistically significant difference ($p>0.05$). The histopathological diagnosis distribution by total and gender is given in **Table 1**. Considering the histopathological diagnosis distribution by age, there was a statistically significant difference ($p=0.01$). While the mean age is younger in benign pathologies, malignant pathologies are seen in older ages.

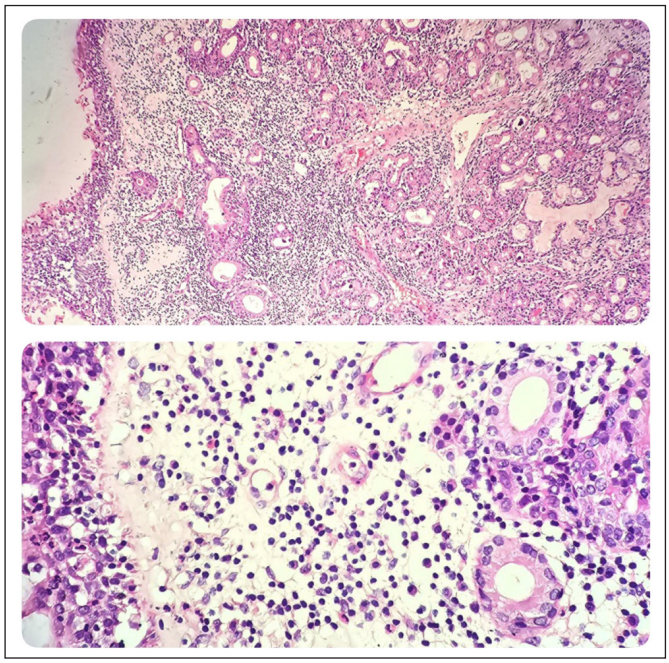

Figure 1. Nasal polyp (upper **Figure** H&E x 100, lower **Figure** H&E x 200)
Top Figure: Inflammatory sinonasal polyp; polypoid sinonasal mucosa with stromal edema, chronic inflammation, and seromucinous gland hyperplasia.
Bottom Figure: Hyalinization of the subepithelial basement membrane and signs of chronic inflammation in the inflammatory sinonasal polyp containing numerous eosinophils.

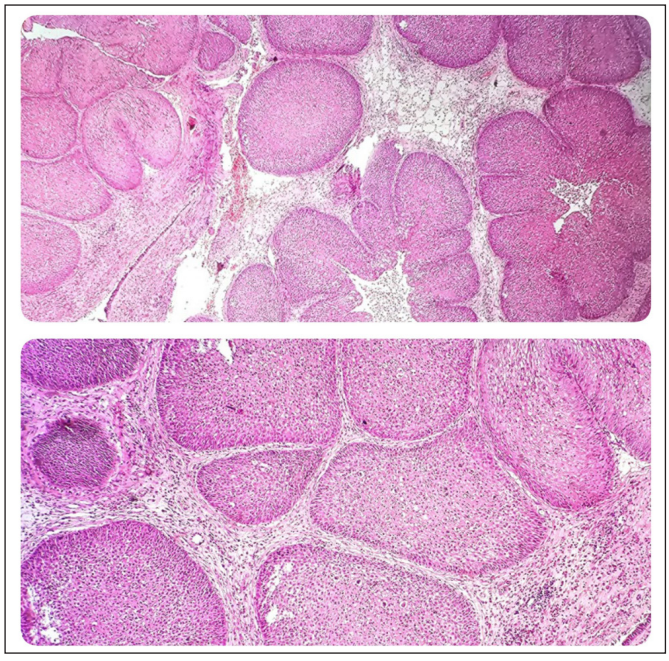

Figure 2. Inverted papilloma (upper **Figure** H&E x 40, lower **Figure** H&E x 100)
In inverted papilloma, the epithelium may be squamous, transitional, or columnar epithelial morphology. Although not clearly visible in our sections, neutrophil migrations and microabscesses into the epithelium can be observed.
Top Figure: The lesion is characterized by thickened-appearing surface epithelium in squamous morphology and inverted pattern with island and cord extensions in the stroma.
Bottom Figure: Although there are no obvious cytological atypia and keratinization findings, chronic inflammation and mild edema may be seen in the stroma.

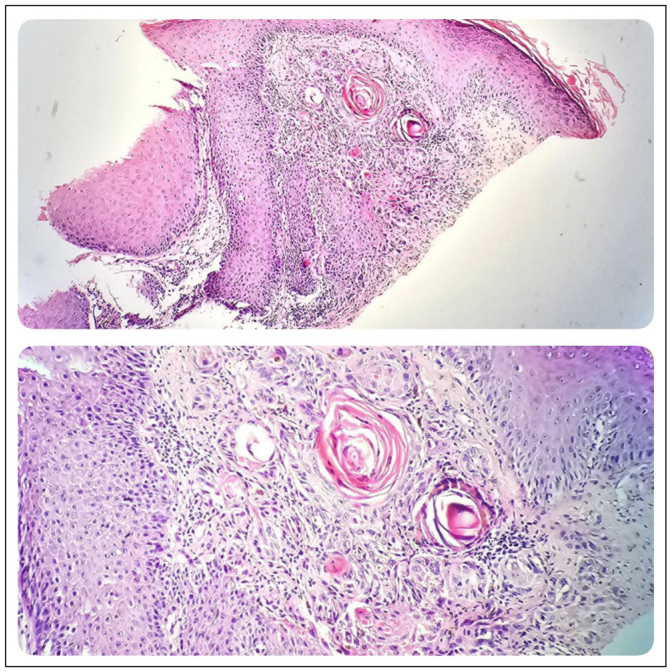

Figure 3. Squamous cell carcinoma (top image H&E x 100, bottom image H&E x 200)
Top Figure: Squamous cell carcinoma; Tumoral lesion with infiltrative pattern originating from squamous epithelium with prominent keratinization, prominent intercellular bridges, mild pleomorphism, mitotic figures in the basal layer and infiltrative islands and small groups under the epithelium.
Bottom Figure: Infiltrative islands formed by squamous cells with extensive eosinophilic cytoplasm with prominent keratin pearl structures in the centre.

Table 1. Histopathological diagnosis distribution in FESS

Pathology	Gender		Total Count (%)
	Male Count (%)	Female Count (%)	
Nasal polyp	207 (74.2%)	72 (25.8%)	279 (76.4%)
Chronic inflammation, edema and congestion (Chronic sinusitis)	37 (60.7%)	24 (39.3%)	61 (16.7%)
Cavernous hemangioma (maxillary sinus)	1 (50.0%)	1 (50.0%)	2 (0.5%)
Pyogenic granuloma	7 (58,3%)	5 (41,7%)	12 (3.2%)
Rhinolite	1 (100.0%)	0 (0.0%)	1 (0.2%)
Benign fibroosseous lesion (mass extending from the anterior maxilla to the floor of the nose)	1 (100.0%)	0 (0.0%)	1 (0.2%)
Inverted papilloma	3 (75.0%)	1 (25.0%)	4 (1.0%)
Squamous cell carcinoma	3 (100.0%)	0 (0.0%)	3 (0.8%)
Dermatofibroma (nasal mucosa)	2 (100.0%)	0 (0.0%)	2 (0.5%)
Total	262 (71.8%)	103 (28.2%)	365 (100.0%)

DISCUSSION

Functional endoscopic sinus surgery is frequently applied in Ear Nose and Throat clinics in our country as well as all over the world. FESS primarily aims to eliminate disease in the paranasal sinuses and to provide sinus ventilation and mucociliary drainage. However, another aim is to facilitate the debridement of diseased tissues and the application of topical treatments to the

mucous membranes of the sinuses.[12] Today, FESS is widely and safely applied in the treatment of bilateral or unilateral benign and malignant sinonasal diseases. The majority of patients are unilateral or bilateral chronic rhinosinusitis and benign sinonasal masses.[13] In our study, benign sinonasal diseases were found in 98.2% of the histopathological examinations. The most common were nasal polyps (76.4%) and chronic sinusitis (16.7%) (CRS). Boer et al.[14] evaluated the postoperative histopathology of 1695 patients who underwent FESS and found that 97.9% of the patients were patients with chronic inflammation with or without polyps. Yaman et al.[15] in their study; In the postoperative histopathological results of 85 patients who underwent bilateral FESS, they found chronic inflammation with or without nasal polyps in all patients. In this study, the most common histopathological lesion after nasal polyps and chronic sinusitis was pyogenic granuloma (3.2%). Pyogenic granuloma is the most common vascular tumor in the nasal cavity. Its etiology is unknown. Two types of hemangiomas have been described in the nasal cavity. The first is pyogenic granuloma and the other is cavernous hemangioma. Pyogenic granuloma constitutes the majority of cases (24). In our study, 2 cavernous hemangiomas (0.5%) and 12 pyogenic granulomas (3.2%) were observed.

Due to the extremely low incidence and rarity of unexpected pathologies of sinonasal tumors, the debate continues regarding the necessity of routine histopathological examination of all nasal specimens. However, some authors suggest that especially malignancy and possible medical legal consequences support routine histological examination.[16] The rate of unexpected diagnosis in bilateral nasal polyp samples ranges from 0% to 0.92%.[17,18] Inverted papilloma is the most common unexpected pathological diagnosis of nasal polyposis.[16,17,19] Inverted papillomas are usually unilateral benign polypoid masses arising from the ectodermal Schneiderian epithelium. Despite its benign histology, it behaves aggressively with local destruction, high recurrence rate and malignant transformation. Although the etiology is not known exactly, a relationship has been found between HPV infection, recurrence rate and malignant transformation.[20] In addition, approximately 11% of inverted papilloma cases are associated with malignancy simultaneously or metachronously.[14] It has been reported that the mean age of inverted papilloma is 55, and the male-female ratio is 2-5/1.[21] In this study, inverted papilloma was seen in 4 (1.0%) patients, with a mean age of 49.5 years and a male-female ratio of 3/1. Garavello and Gaini examined 2147 patients and found inverted papilloma in seven and adenocarcinoma in one.[16] Diamantopoulos et al.[17] In their study in which they examined 2,021 patients, they found 11 inverted papillomas, 1 adenocarcinoma, and 3 squamous cell carcinomas. In the study of Romashko and Stankiewicz on 277 patients with nasal polyps, no unsuspected pathology was found.[18] Kale et al.[19] only one case of inverted papilloma was found. In the meta-analysis of 3772 patients, only 3 unexpected malignant diagnoses and 18 unexpected benign diagnoses were found.[13]

In our study, in which we evaluated the histopathological results of 365 patients retrospectively, we observed SCC in only 3 (0.8%) patients and inverted papilloma in 4 (1.0%) patients. There was no unexpected diagnosis. They were clinically suspicious cases and diagnostic FESS was performed. All of the malignant and premalignant lesions were patients who underwent unilateral FESS. Patients with neoplastic specimens were significantly older than those with benign specimens. Age correlated with neoplasm, while gender did not differ between patients with neoplasms and patients with inflammatory lesions. Sinonasal tumors have the highest incidence in the fifth to seventh decades and are predominantly male. All 3 SCC cases in our study were male and the mean age was 60.3.

Finally, we acknowledge that the retrospective nature of the study may be an important shortcoming and large-scale prospective studies are needed.

CONCLUSION

FESS surgery is recommended because of easy access to intranasal masses, easy and complete removal of the pathological lesion, short operation time and minimally invasiveness. Benign pathologies constitute the majority of paranasal sinus samples taken after FESS surgery. It is rarely seen in malignant pathologies. It was concluded that early diagnosis of premalignant and malignant pathologies could be possible with routine histopathological sampling.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Kırıkkale University Non-interventional Clinical Researches Ethics Committee (Date: 19.04.2023, Decision No: 2023.04.09).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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